THE COMPARISON STUDY OF DIFFERENT ADDITIVES ON CHARACTERISTIC AND PERFORMANCE OF *FICUS DELTOIDEA*- LOADED NIOSOMES

NURUL BASHIRAH BINTI YUSOF

UNIVERSITI TEKNOLOGI MALAYSIA

THE COMPARISON STUDY OF DIFFERENT ADDITIVES ON THE CHARACTERISTIC AND PERFORMANCE OF *FICUS DELTOIDEA*- LOADED NIOSOMES

NURUL BASHIRAH BINTI YUSOF

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Master of Engineering (Bioprocess)

Faculty of Chemical Engineering
Universiti Teknologi Malaysia

AUGUST 2015

To my beloved mother, Mrs Halimah @ Fatimah Binti Awang. My supported family and friends. May Allah S.W.T bless us always.

ACKNOWLEDGEMENT

My deepest thanks and praise to Allah S.W.T for His love and blessing throughout the research and preparation of this thesis.

Foremostly, I would like to express my warmest gratitude to my lovely mother Mrs Halimah @ Fatimah Binti Awang, and family for their caring, love, and supporting along completing this thesis. I sincerely would like to thank to my supervisor, Assoc. Prof. Dr. Azila Binti Abdul Aziz for her continuous guidance during all the stage of my research work and for his willingness to help. Without her continue support, interest, wisdom and ideas during our discussion, this thesis would not have been implemented and executed well.

I would like to acknowledge the Ministry of Agriculture (MOA) for supporting and funding this project on the "The Formulation and Delivery of an Anti-Aging Cosmeceutical Serum Based On *Labisia Pumila* and *Ficus Deltoidea*-Loaded Niosomes" with the provided NRGS. My special thanks to Prof Dr Mohamad Roji Bin Sarmidi as a Project Leader for that project and for giving his trust to me to handle that project.

I express my sincere thanks to Mr. Albert Lim from DKSH Technology Sdn Bhd for letting me to use the Zetasizer Nano ZS. Without his assistance, this research would

not have been finished successfully. I take pleasure in thanking my friends Siti Maria Abdul Ghani, Nur Zatul Iradah Binti Roslan, and special gratitude also go to research officer, Mrs. Rohaiza Binti Muda for all guidance and contribution to the success of my research.

With the full cooperation from these specials people, I was able to complete my thesis successfully. This Master would not been possible without their support.

ABSTRACT

To ensure the effectiveness of any cosmetic formulation, the active ingredients should be able to penetrate the natural barrier of the skin, which is the stratum corneum (SC). In order to ensure that active ingredients penetrate the skin barrier, a carrier must be utilized to carry the active ingredients. The purpose of this study was to develop a stable niosomal delivery system for *Ficus deltoidea* by using sorbitan monostearate (Span 60) as a surfactant. In addition, cholesterols, β-sitosterols, and PEG-8 caprylic/capric glycerides (Labrasol) were applied as additives. These vesicles were characterized based on zeta potential, vesicle size distribution, encapsulation efficiency (EE %), niosome morphology, and *in-vitro* permeation. Following application of *Ficus deltoidea* loaded niosome on reconstructed human pigmented epidermis, the efficacy of the niosome in reducing melanin level was tested based on the microscopic observation of melanin distribution and measurement of melanin content. The developed niosomes (Span 60/cholesterol/Labrasol and Span 60/β-sitosterols/Labrasol) were found to be the most stable and promising niosomes after 3 months of storage, as both niosomes preserved their stability in terms of zeta potential, vesicle size and loading capacity. Zeta potential for both niosomes was measured at approximately -30 mV. The vesicle size was found to be in the range of 140 nm to 170 nm and both niosomes had high encapsulation efficiency (87.55 ± 5.35 % and 78.38 ± 0.37 % for Span 60/cholesterol/Labrasol and Span 60/β-sitosterol/Labrasol niosomes, respectively). These results indicated that β-sitosterols could also be option as additive since it displayed similar characteristics as cholesterol and the stability of loaded niosomes was improved with the inclusion of Labrasol. This study suggested the potential use of loaded niosome as a stable carrier for delivery of anti-melanogenic effects of *Ficus deltoidea*.

ABSTRAK

Bagi memastikan keberkesanan formula kosmetik, bahan aktif harus dapat menembusi halangan semulajadi pada kulit, iaitu stratum korneum (SC). Dalam usaha untuk memastikan bahan-bahan aktif itu dapat menembusi halangan kulit dan pergi terus ke sel-sel yang disasarkan, satu agen pembawa haruslah digunakan untuk membawa bahan aktif ini. Tujuan kajian ini adalah untuk membangunkan satu sistem pembawa "niosomal" yang stabil untuk *Ficus deltoidea*, Di mana, monostearate sorbitan (Span 60) digunakan sebagai surfaktan. Di samping itu, kolesterol, β-sitosterol dan PEG-8 kaprilik / kaprik gliserida (*Labrasol*) telah digunakan sebagai bahan tambahan. Ciri-ciri vesikel ini telah dikatogerikan berdasarkan potensi zeta, taburan saiz vesikal, kecekapan pengkapsulan (EE%), morfologi niosom dan penyerapan *in-vitro*. Kemudian keberkesanan niosom diuji berdasarkan pemerhatian mikroskopik terhadap melanin kerana *Ficus deltoidea* mempunyai kesan anti-melanogenik. Span 60/cholesterol/*Labrasol* dan Span 60/β-sitosterol/*Labrasol* niosom telah ditemui sebagai niosom yang paling stabil dan tetap kekal setelah berada dalam simpanan selama 3 bulan di mana kedua-dua niosom mengekalkan kestabilan mereka dari segi potensi zeta, saiz vesikal, dan kecekapan pemerangkapan. Zeta potensi untuk kedua-dua niosom diukur pada kira-kira -30 mV. Saiz vesikal didapati dalam lingkungan 140 nm hingga 170 nm dan kedua - dua niosom mempunyai kecekapan pengkapsulan yang tinggi iaitu (87.55 ± 5.35%, 78.38 ± 0.37%) masing- masing untuk Span 60 /cholesterol/ *Labrasol* dan Span 60 / β -sitosterol / *Labrasol*. Keputusan ini menunjukkan bahawa β -sitosterol boleh menjadi pilihan sebagai sokongan tambahan kerana ia memaparkan ciri yang sama dengan kolesterol dan kestabilan niosom telah dipertingkatkan dengan penambahan *Labrasol*. Kajian ini mencadangkan potensi dan keberkesanan niosom sebagai pembawa yang stabil untuk menyampaikan kesan anti-melanogenik *Ficus deltoidea*.